PHENOLOGY OF COMMON BEAN FROM THE MESOAMERICAN GENE POOL IN THE HIGHLANDS OF MEXICO.[1]

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Introduction. In common bean, daylength response plays a major role in controlling the rate of flower initiation and development. Photoperiod sensitivity is important in adapting landraces to their traditional growing locations and cultural practices. In contrast, a day-neutral response favors wide adaptation. Although most bean cultivars in temperate zones are relatively insensitive to daylength both for initiation and development of flowers, cultivars from the Mexican Highlands are particularly sensitive to daylength during flower development (White and Laing, 1989). In the Mexican Highlands, two races of common bean are widely distributed, the Durango race in the Central-North semiarid highlands and the Jalisco race in the sub-humid highlands of central Mexico (Singh *et al.*, 1991).

In 1997, a group of 169 genotypes of varying origins, growth habits and gene pools were evaluated at two locations of the Mexican Highlands. Growth habit type IV genotypes from the Jalisco race showed the largest response (phenological plasticity) in modifying the rate of flowering across planting dates, while genotypes from the Durango race had an intermediate response and most materials of the Mesoamerica and Nueva Granada races were neutral. It was concluded that a gradient in photoperiod response existed in the highlands from south to north and that the response was associated with late maturity.

Objective. This research further compared the rate of flowering in bred cultivars and landraces of the three genetic races in the Mesoamerican gene pool.

Materials and methods. In 1998, a trial was conducted with 100 genotypes from the three races in the Mesoamerican gene pool, all of them of type III habit since most highland landraces and bred cultivars display this growth habit. The trial was conducted in two planting dates in the field at Texcoco, Mexico(19°19'N and 2240 masl) and Pabellón, Aguascalientes (22°11'N and 1912 masl) and under controlled conditions in the greenhouse under two daylength treatments: natural and extended (18 h). For all trials a 10 X 10 Simple Lattice Design was utilized. In the field, plots were of a single 5 m row; for the greenhouse trial, data were recorded on three 5 l pots per treatment with two plants per pot. Date of flowering was recorded in all trials, and in the field trials, data on maturity and seed yield were also measured.

Results and Discussion. For Texcoco, late planting did not accelerate flowering for any race (Table 1). At Pabellón, late planting decreased time to flower by 4.5, 4.0 and 2.0 days in the Durango, Jalisco and Mesoamerican races, respectively. At Pabellón, bred cultivars in each race showed a slightly reduced time to flowering as compared to landraces (Table 1). In the site at Texcoco, the average maximum and minimum temperatures were from 1 to 2 °C below those in Pabellón (Table 2), and as expected, flowering was slightly delayed at the cooler site.

In the greenhouse, most of the landraces and bred cultivars in the Durango and Jalisco races were highly photoperiod sensitive, while in the Mesoamerican race, landraces were intermediate and bred cultivars neutral (Table 1). These results indicate that there is not a gradient in photoperiod response in the highland germplasm, as had previously been suggested. The gradient we had observed in the field might be due to a photoperiod x temperature interaction and/or to a differential response of the genotypes to temperature. In this trial, a white-seeded landrace (blanquito) type III growth habit from Zacatecas was neutral and many Flor de Mayo landraces from the Jalisco race showed an intermediate photoperiod response.

In general, without distinction of race, bred cultivars at both locations matured more rapidly and had higher seed yields than landraces. This suggests that recently bred highland cultivars are showing improved adaptation to the region. Phenology was delayed at the highest site, probably due to lower temperatures. Landraces and bred cultivars from the Jalisco and Durango races from the highlands of Mexico were largely highly photoperiod sensitive, but interesting exceptions were noted that merit further study.

Table 1. Agronomic traits of bean genotypes from three different races in two planting dates (normal = 1 vs. late = 2) at two locations in the Highlands of México. 1998.

	Days to Flowering				Days to Maturity				Grain Yield kg ha^{-1}				Greenhouse		
	Texcoco		Pabellón		Texcoco		Pabellón		Texcoco		Pabellón		Days to Flowering		
Race¶	1	2	1	2	1	2	1	2	1	2	1	2	N§	18h	Dif
DL	47	48	44	39	105	114	102	93	1488	1589	1512	1437	44	72	28
DB	44	46	41	37	100	111	98	92	1619	1810	1766	1524	45	70	25
JL	51	51	47	42	111	118	106	95	1628	1651	1450	1636	46	69	23
JB	50	51	45	42	110	117	103	92	1666	1906	1771	1989	47	66	19
ML	51	52	48	47	110	120	105	96	1638	1373	1404	1852	46	62	16
MB	53	52	45	48	103	113	89	95	1700	1452	526	1033	49	50	1
Mean	49	50	45	43	107	116	101	94	1623	1630	1404	1579	46	65	19

¶ DL= Durango Landrace, DB=Durango Bred; JL=Jalisco Landrace, JB=Jalisco Bred; ML=Mesoamérica Landrace, MB= Mesoamérica Bred.
§ N= Natural daylength, 18h= Extended daylength, Dif=Difference.

Table 2. Average minimum, maximum and mean temperatures (°C) at two development stages of 100 bean genotypes grown at two locations in the Highlands of México.1998.

		From sowing to first flower			From flowering to physiol. maturity		
Year	Location	Minimum	Maximum	Mean	Minimum	Maximum	Mean
1997	Aguascalientes	12.8	27.6	20.2	11.9	27.7	19.8
	Texcoco	10.2	24.7	17.5	10.4	24.3	17.4
1998	Aguascalientes	13.5	26.3	19.9	11.5	24.7	18.1
	Texcoco	10.9	25.7	18.4	11.6	23.2	17.5

References.

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